

them. Adult plume moths were counted, separated by sex, and released back into the environment. Parasitoid adults were aspirated upon emergence, placed in alcohol, and retained for identification. Collections were made weekly in this manner from May through September of both years. Six species of primary parasitoid were reared from the artichoke plume moth in this location over the two year period: *Bracon hyslopi* (Viereck) (Braconidae: Braconinae: Braconini); *Caliephialtes notandus* (Cresson) (Ichneumonidae: Ephialtinae: Pimplini); *Campoplex polychrosidis* Viereck (Ichneumonidae: Porizontinae: Campoplegini); *Diadegma acuta* (Viereck) (Ichneumonidae: Porizontinae: Porizontini); *Colpognathus helvus* (Cresson) (Ichneumonidae: Ichneumoninae: Alomyini); and *Phaeogenes cynarae* Bragg (Ichneumonidae: Ichneumoninae: Alomyini). Two species of secondary parasitoid were reared as well: *Gelus* sp. (Ichneumonidae: Gelinae: Gelini); and *Catolaccus aeneoviridis* (Girault) (Pteromalidae: Pteromalinae: Pteromalini). The two Alomyine Ichneumonids are apparently specific to the artichoke plume moth (Bragg, D. E. 1971. Pan-Pacific Entomol., 47: 57–62). *Phaeogenes* and *Diadegma* were reared in substantial numbers both years throughout the period of plume moth activity.

Records.—WASHINGTON. GARFIELD Co.: Pataha Crk, 1 km E of Pomeroy, ex *Platytilia carduidactyla*.

David E. Bragg, Department of Entomology, Washington State University, P.O. Box 190, Pomeroy, Washington 99347-0190.

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Scientific Note

THE REVIVAL OF RICE-FIELD GRASSHOPPERS AS HUMAN FOOD IN SOUTH KOREA

Grasshoppers have been a common food for people in many parts of the world (Bodenheimer, F. S. 1951. Insects as human food, W. Junk, The Hague). Rice-field grasshoppers (Acrididae, *Oxya* spp.) are eaten in most east Asian countries. In Korea, these grasshoppers are called *metdugi* and were a common food eaten as a side dish at meals, as a lunch box ingredient and as a drinking snack (K. S. Woo, personal communication). The use of rice-field grasshoppers declined during the 1960s and 1970s with increased insecticide use.

I observed Koreans gather, pan-fry and eat *metdugi* during a picnic in October 1989. Samples were subsequently identified as *Oxya velox* (Fabr.). During four years (1989–1992) of visiting the Seoul markets, I did not see any *metdugi*, where they were once common (G. S. Yun, personal communication), and where silk moth pupae (*Bombyx mori* L.), a human food that is a by-product of the Korean silk industry, are almost always present. Some *metdugi* were sold in 1989 in a beer hall in the city of Suwon; a dish of about 20 was 5000 Won (US \$7.57) (K.



Figure 1. Korean rice-field grasshoppers (*Oxya* spp.) prepared for the table.

S. Woo, personal communication). In 1990, a discount store for Korean Government employees sold dried *metdugi* seasoned with soy sauce, sugar and sesame oil, in 130 g packages for 3750 Won (US \$5.20).

I was able to contact J.-R. Lee the president of the small food company that marketed these *metdugi*. He said that the *metdugi* were gathered in areas away from agricultural fields (and insecticides), such as in mountains and even in the outer DMZ military security zone, where agriculture is limited. The farmer-collectors sold their *metdugi* at local five-day markets (open one day every five days), where his company would purchase them. Some were also obtained earlier in the 1980s from artificial rearing. Rearing of *metdugi* proved difficult because of insecticide contamination of the food and water used. The *metdugi* also were very sensitive to the carbon monoxide gas produced by charcoal heaters. These problems, and increased labor costs, ended the commercial rearing attempts. Mr. Lee's business declined because of the lack of *metdugi*, and in 1990 it ended. The *metdugi* food culture of Korea had become rare and seemed to be disappearing.

Then on 8 Oct 1990, the Korean language newspaper *Chungang Ilbo* published an article by Huh Sang-Chun titled "The *metdugi* revival." It described the rebirth of *metdugi* gathering and selling in Kyungsang Namdo, a province in the southern part of the country. Shortly after the article appeared, I visited the center of this revival, Chahwang Myun (a district of Sanchung County), where I interviewed the Chahwang Myun Agricultural Cooperative Manager Park Chung-Ki, and two local farm women, Im Pun-Nam and Kim Ssang-Soon, who were active *metdugi* collectors.

Chahwang is a small district with about 3000 people, most of whom belong to 744 farm families that cultivate 642 ha of paddy rice (1990 figures). Before insecticide use intensified in the 1960s, *metdugi* were abundant in and around the rice fields and were collected for both home use and sale. The elevation of Chahwang Myun is from 380 to 420 m, so it has cooler nights and consequently fewer problems with rice pests than areas at lower elevations. Despite this situation, the farmers could not avoid the government policy requiring at least three sprays per season. (Some Korean entomologists that I subsequently spoke with doubted that there was a government policy requiring the spraying of rice, despite the Chahwang-Myun people's statements about such a policy.) In 1981 the rules mandating insecticide use loosened and farmers started using less, which allowed the *metdugi* populations to begin to increase. In 1982 some *metdugi* began to be collected and sold again in the local market at Sanchon.

The decline in insecticide use and the desire of some Koreans to eat pesticide-free rice led to the development of organic rice farming in Chahwang Myun. This was economically viable because the yields of rice were the same in unsprayed fields as in sprayed fields, and organic rice sold (and still sells) for higher prices. In 1989, the Chahwang Agricultural Cooperative, which functions primarily to buy, mill and sell rice, began to buy dried *metdugi* from the farmer-collectors. In that year, more than 600 liters were purchased from more than 300 families. The farmers earned 4000 Won (US \$6.06) per liter. The Cooperative sold the *metdugi* in bulk for 4250 Won per liter (US \$6.44). The farmers probably sold another 600 liters at the five-day market and on the street. In 1990, more than 600 families (out of 744) sold 1744 liters of *metdugi* to the Cooperative at 5000 Won per liter (US \$6.98). The Cooperative sold them for 6500 Won per liter (US \$9.08). Much of the 1990 sale went to a supermarket company in Pusan, which divided the *metdugi* into 0.2 liter packages and sold these for 3000 Won (US \$4.19). *Metdugi* were also sold by mail-order and to out-of-town visitors to the Cooperative.

In 1990, the average collector sold 2 liters of *metdugi* to the Cooperative, but some collectors brought in as much as 40 liters, and one man, who had no rice field to tend, sold 160 liters to the Cooperative. *Metdugi* are most commonly collected by older women, usually from mid October to early November. They are collected by hand primarily from rice fields until the rice is harvested, then some are taken from other crops (such as dry beans) and from wild vegetation in the surrounding mountains. The average collection rate is about 0.25 liter per hour, while the best rate is 1.0 liter per hour. Both Mrs. Im and Mrs. Kim collect for 15 days each year on a part-time basis. Collected *metdugi* are steamed or boiled, then dried in the sun for one day and in a room for two more days. In 1990, Mrs. Im (age 58) collected 100 liters, with the help of her husband, and sold 40 liters to the Cooperative. She sold most of the remainder at the five-day market and gave some to relatives. She was pleased to say that her city-dwelling grandchildren get *metdugi* in their lunch boxes. She has been collecting and selling *metdugi* for five years. Mrs. Kim (age 37) has been collecting and selling *metdugi* for eight years. She collected 80 liters in 1990.

During 1990, the income per hour for collecting *metdugi* for these women ranged from 1250–5000 Won (US \$1.75–6.98), excluding the time spent in processing and marketing the *metdugi*. The average 1990 income for farm households (3.8 people) was US \$16,706 (Korean Ministry of Agriculture, Forestry and Fisheries.

1992. Statistical Yearbook of Agriculture, Forestry and Fisheries) and many families in hilly areas such as Chahwang Myun earned less. The added income from *metdugi* collection and sale was, then, significant to these families. Mrs. Im said “*metdugi* helps us live.”

A one liter package of *metdugi* was purchased from the Cooperative and the grasshoppers in a subsample of about one third of a liter (149 insects) were identified. Three species were present. *Oxya velox* was the most common species, comprising 84.5% of the total, then *Oxya sinuosa* Mistshenko with 14.8%, and a single *Acrida lata* Motschulsky. *Oxya velox* is a yellow-green grasshopper 27–37 mm in length found in Japan, Korea, China and Taiwan (Cho, B. S. 1969. Illustrated encyclopedia of fauna and flora of Korea, Vol. 10, Sam Hwa Pub. Co., Seoul). *Oxya sinuosa* is yellow-green, 30–38 mm long and occurs throughout Korea (Lee, H. S. and C. E. Lee. 1983. Nature and Life, Taegu, South Korea, 13: 1–23). *Acrida lata* is a large 54–89 mm grasshopper, green or grey-brown colored, which occurs in Japan, China and Taiwan as well as Korea (Cho 1969). I did not expect the *A. lata* in the sample, but it is one of the grasshoppers eaten in Korea (Jang Hoon Lee, personal communication).

In 1991 and 1992, large numbers of *metdugi* continued to be bought and sold by the Chahwang Myun Cooperative and many people came to buy directly from the farmers (Min Pyung-Hong, personal communication). In 1992, the Cooperative bought *metdugi* for US \$9.91 per liter and sold them at a bulk rate for US \$12.03 per liter.

Many Koreans consider *metdugi* to be a health food. Indeed, *metdugi* (probably *Oxya* spp.) have high levels of iron (43 mg/100 g), vitamin B2 (5.6 mg/100 g) and protein (64.2 g/100 g) (Chai, R. S., Y. Y. Yu, Y. H. Park, K. K. Kim, Y. J. Moon & H. H. Kwon. 1962. Reports National Chemistry Laboratories, Seoul, 10: 56–64). In Chahwang, *metdugi* is used to prevent and cure constipation and to treat heart problems. *Metdugi* (*O. velox*) is used as a drug in traditional Korean medicine, prescribed to treat the convulsions of children, coughs, tetanus and weakness (Kim, J. G. 1984. Illustrated natural drugs encyclopedia. Nam San Dang Pub., Seoul).

The food preparations of dried *metdugi* vary. Sometimes they are eaten dried without seasoning. They are usually pan-fried with or without oil after the wings and legs have been removed. During or after cooking, they are flavored with sesame oil and salt, or sesame oil and sugar, or soy sauce with or without sugar. I have also seen live ones fried whole. These turn red like shrimp as they cook. Many of these preparations produce a product with good snack food essence. They are bite-sized, crispy, crunchy, and salty and/or slightly sweet. Korean preparations of rice-field grasshoppers are, to my taste, much better than the sweet sticky Japanese preparations of *Oxya* that are sold in tins and restaurants in Japan as *imago*.

For older Koreans, much of the appeal of eating *metdugi* are the feelings of nostalgia that it brings. Korea has undergone very rapid industrialization and urbanization during the past 25 years. The *metdugi* revival gives at least some people a chance to taste the past.

Koreans and other east Asian people, in general, use and enjoy insects more than do Americans and Europeans (Pemberton, R. W. 1988. Pan-Pacific Entomol., 64: 81–82; 1990. 66: 93–95; 66: 172–174).

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Robert W. Pemberton, *Asian Parasite Laboratory, United States Department of Agriculture-Agricultural Research Service. Current address: Aquatic Weed Control Research, USDA ARS SAA, 3205 College Ave, Ft. Lauderdale, Florida USA 33314.*

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Scientific Note

***XYLOCORIS GALACTINUS* (FIEBER) (HEMIPTERA: ANTHOCORIDAE) NEWLY DISCOVERED IN MONTANA STORED GRAIN**

Herein, we note the occurrence of the predaceous bug, *Xylocoris galactinus* (Fieber) in stored grain in Montana, one of the top four states in small grain production and storage (Montana Agricultural Statistics Service. 1991. Helena, Montana). *Xylocoris galactinus* has been introduced into the New World, where it often occurs in stored grain (J. A. Slater & R. M. Baranowski. 1978. How to Know the True Bugs. Wm. C. Brown Co. Dubuque, Iowa). It is reported transcontinentally in Canada (T. J. Henry & R. C. Froeschner. 1988. Catalog of the Heteroptera, or True Bugs, of Canada and the Continental United States. E. J. Brill Publ. Co. New York), but has not been recorded from the northern great plains of the United States (Henry & Froeschner 1988). California, Idaho and Missouri are the only states recorded to harbor this species west of the Mississippi River. Based on its distribution records, this species may be better able to survive in colder northern climes than does the better known *Xylocoris flavipes* (Reuter).

During surveys of stored grain insects, F. Dunkel found an established population of *X. galactinus* at the Montana State University Southern Agricultural Research Center near Huntley, Montana. This population represents a significant range extension of over 320 km from the closest areas previously known to harbor the species in the Alberta and Idaho grain growing regions.

The population was found in a 0.25 metric ton barley spill adjacent to grain storage bins. Within this spill, the population density of *X. galactinus* exceeded 200 immatures and >25 adults per kg of grain. The population was sampled by